REMARKS

Claim 1 has been amended to recite that the high-density electrode contains carbon fiber having a fiber filament diameter of 1 to 1,000 nm in an amount of 5 mass% or less of the high-density electrode. Support is found in Table 1 at page 46 of the specification, including examples of the high-density electrode of the invention containing carbon fiber in an amount of 2 mass % and 5 mass%.

Review and reconsideration on the merits are requested.

Claims 1, 2, 4-10, 30-33 stand rejected under 35 U.S.C. § 103 as being unpatentable over "Nishimura" (EP 1,191,131) in view of "Gernov" (U.S. Patent 6,194,099) and "Parmentier" (U.S. Patent 6,361,900).

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura, Gernov and Parmentier as applied to claims 1, 2, 4-10, 30-33 above, and further in view of "Ouvry" (U.S. Patent 6,444,347).

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura, Gernov and Parmentier as applied to claims 1, 2, 4-10, 30-33 above, and further in view of "Qu" (U.S. Patent Application Publication 2003/0049531) and "Ishikawa" (U.S. Patent Application Publication 2003/0118908).

Claim 17 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura, Gernov, Parmentier, Qu, and Ishikawa, as applied to claim 14 above and further in view of "Yamada" (U.S. Patent 6,040,092).

Claim 34 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura, Gernov, and Parmentier as applied to claims 1, 2, 4-10, and 30-33 above, and further in view of "Takahashi" (U.S. Patent Application Publication 2003/0124424).

Applicants respond as follows.

(1) Gernov

The electrodes in Examples 1 to 5 and 7 of Gernov contain carbon fiber in an amount as high as 20%-31%, which greatly differ from the electrode of the present invention in terms of structure.

Gernov describes that preferred solid composite cathodes comprise between 2 weight percent and 10 weight percent non-activated carbon nanofibers and most preferred solid composite cathodes comprise between 3 weight percent and 6 weight percent carbon nanofibers (see col. 14, lines 27-34). The cathodes in Examples 6 and 8-10 comprising 2 to 5 weight percent carbon nanofibers are preferred examples and fall within the range as defined by the amended claim 1. However, the porosity calculated in Examples 6 and 8-10 is found to be very high as shown below, which is far from the porosity of 25% or less as defined in the present claims. That is, the cathodes as having "a low porosity" disclosed by Gernov actually have a far higher porosity compared to those of the present invention as described from col. 2, line 60 to col. 3, line 3.

The porosity of the cathodes in the Examples of Gernov was determined by comparing the true density calculated from the material used for the cathodes and the density of the cathodes obtained therefrom.

Example 6

-	True density:	elemental sulfur	1.9222 g/cm^3	85 wt%
		Carbon Pigment (XE-2)	1.8 g/cm^3	12 wt%
		Carbon Nanofiber	2.1 g/cm^3	3 wt%

Accordingly, the weighted average true density is 1.91 g/cm^3 (0.523 cm^3/g).

- Cathode density: 0.550 g/cm^3 (1.82 cm^3/g)
- Accordingly, the calculated porosity is 71 Vol%.

Example 8

- True density:	Carbon-sulfur-polymer*	1.9222 g/cm^3	70 wt%
	Carbon Pigment (XE-2)	1.8 g/cm^3	10 wt%
	Carbon Nanofiber	2.1 g/cm^3	5 wt%
	SiO_2	2.2 g/cm^3	5 wt%
	PEO	0.887 g/cm^3	10 wt%

Accordingly, the weighted average true density is 1.83 g/cm^3 (0.547 cm^3/g).

- Cathode density: 0.377 to 0.393 g/cm^3 (2.5445 to 2.6525 cm^3/g)
- Accordingly, the calculated porosity is 79 Vol%.

Example 9

- Weighted average true density: 1.83 g/cm^3 (0.547 cm^3/g) (the same as in Example 8)
- Cathode density: 0.319 to 0.385 g/cm^3 (2.5974 to 3.1348 cm^3/g)
- Accordingly, the calculated porosity is 79 to 83 Vol%.

Example 10

- True density:	Carbon-sulfur-polymer*	1.9222 g/cm^3	83 wt%
	Carbon Pigment (XE-2)	1.8 g/cm^3	10 wt%
	Carbon Nanofiber	2.1 g/cm^3	2 wt%
	Poly acrylamido-co-diallyldimethylammonium choloride	1.02 g/cm^3	4 wt%
	PEO	0.887 g/cm^3	10 wt%

Accordingly, the weighted average true density is 1.87 g/cm^3 (0.536 cm^3/g).

- Cathode density: 0.485 g/cm^3 (2.062 cm^3/g)
- Accordingly, the calculated porosity is 74 Vol%.

* Based on the description at col. 12, line 61 that "expecially most preferred are polymeric electroactive sulfur-containing materials with greater than 90 weight percent sulfur", the true density was calculated based on the material of 100 weight percent sulfur.

(2) Parmentier

The invention of Parmentier relates to carbon fiber electrodes and is far from the present invention disclosing a high density electrode containing 5 mass% or less carbon fiber. Hence, one skilled in the art would not have been motivated to combine Nishimura and Gernov which teach adding carbon fiber to the electrode active substance with Parmentier which is directed to a carbon fiber anode. Furthermore, as repeatedly noted in previous responses, the porosity of the anode of Parmentier is higher than that of the electrode of the present invention.

(3) Non-obviousness

The Examiner asserts that the present invention would have been obvious by modifying Nishimura to employ the teachings of Gernov and Parmentier. However, as discussed above, the porosity of the electrode taught by Gernov is far from 25% or less as taught by the present invention. Also, Parmentier relates to a carbon fiber anode and, as noted in the previous response, the porosity of the anode of Parmentier is higher than that of the electrode of the present invention. Therefore, one skilled in the art would not have arrived at the present invention, even by combining the teachings of Nishimura, Gernov and Parmentier.

The present invention has superior effects (high charging/discharging performance and cycling characteristics) even with an electrode having a porosity which is far lower than one

skilled in the art would adopt as a matter of common sense, and therefore would not be regarded as "obvious to try" for one skilled in the art.

(4) "Response to Arguments"

In the final Office Action, the Examiner relies on Parmentier as evidence to the effect that the range of 25% or less is known in the art. Gernov was cited as teaching that porosity is a result-effective variable, such that it would have been obvious to manipulate the porosity to a desired range of 25% or less. However, what one skilled in the art expects as "a low porosity" is a porosity in the same range as taught by Gernov (i.e., 40-60%). This is because one of ordinary skill in the art generally considers that a porosity of 40% or lower results in a decrease in permeability of the electrolytic solution and a decrease in the charging/discharging performance and cycling characteristics.

Parmentier discloses a porosity of 10-30%. However, in Parmentier the expectation is to use carbon fiber fabric or nonwoven fabric as substitute for a binder, and to use these after heat treatment. It would be clear to one of ordinary skill in the art that a number of air voids are present in carbon fiber fabric and nonwoven fabric, and the same holds for these fabrics after the heat treatment. Therefore, even if Parmentier discloses an anode having a porosity of 10-30%, one can clearly understand that the material taught by Parmentier has a lower density and more voids as compared to the material comprising active substance particles and carbon fiber as claimed. Accordingly, the term "porosity" should be understood to have a meaning in Parmentier different from that of the present invention. Further, Parmentier does not suggest a porosity of 25% or less in an electrode comprising active substance particles and carbon fiber. Rather, Parmentier includes disclosure that teaches away from the present invention.

For the above reasons, it is respectfully submitted that the amended claims are patentable over the cited prior art, and withdrawal of the foregoing rejections is respectfully requested.

Withdrawal of all rejections and allowance of claims 1-9 and 18-45 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Abraham J. Rosner
Registration No. 33,276

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: November 30, 2010